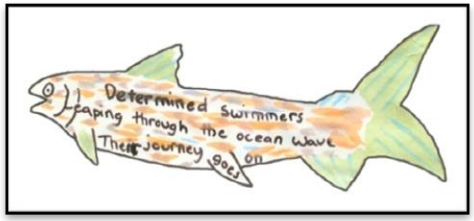
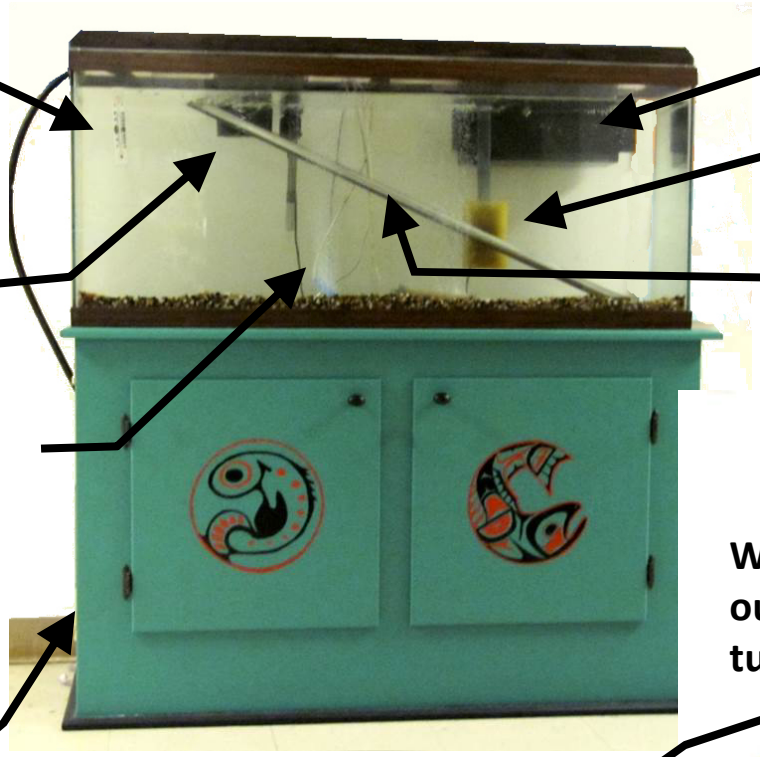
MAINTAINING YOUR SALMON AQUARIUM



Typical Tank Setup



Thermometer

Large filter

Small filter

Initial filtering or screen

External cooling wand chiller

Aerators

Water outlet tube

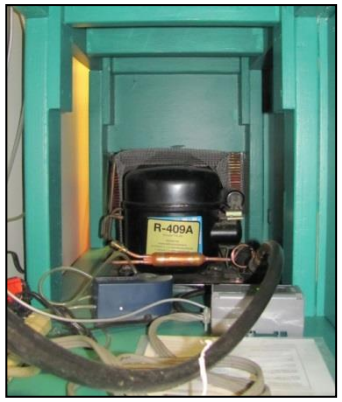
Water pump for chiller

Cabinets must have proper air flow on at least three sides.

AquaEuro chiller ¼ HP

Locating Your Chiller

Provide adequate air circulation to keep the chiller cool.
Locate near a water source and an electrical outlet.
If possible, position the chiller off the floor to prevent dust accumulation.

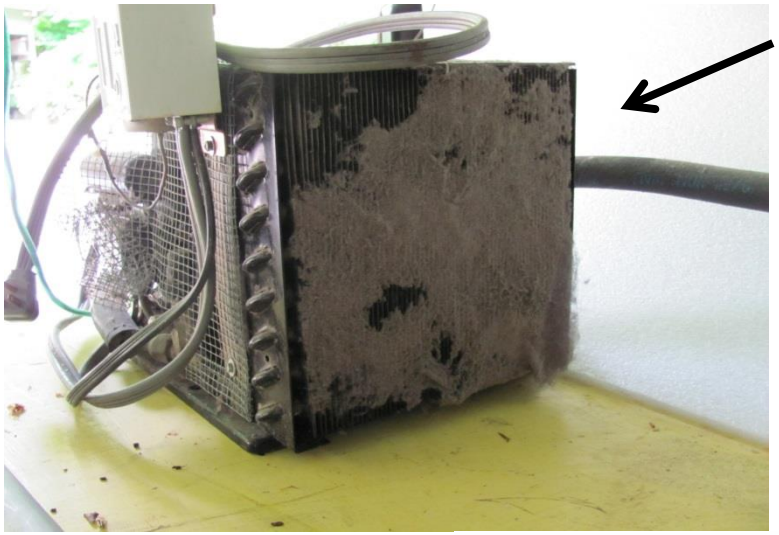


Left Side Open

Left Side With Vented Door

Right Side With Second Vent

Maintaining Chiller Air Flow



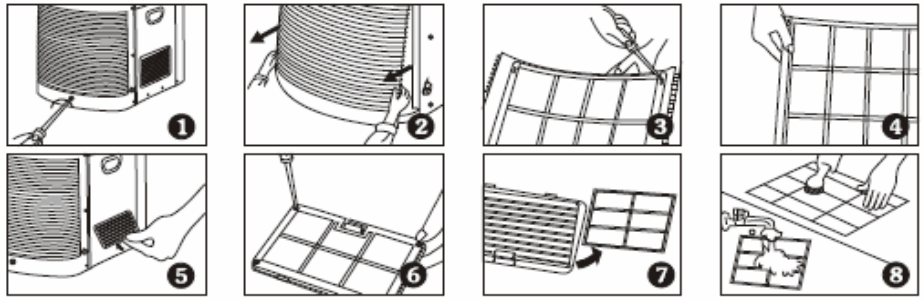
Intake aluminum fins on wand chiller

Keep the condenser (the motor, filters, etc.) free of dust and have plenty of air circulation around it. Clean once or twice a year. Chillers are expensive to purchase and expensive to repair.

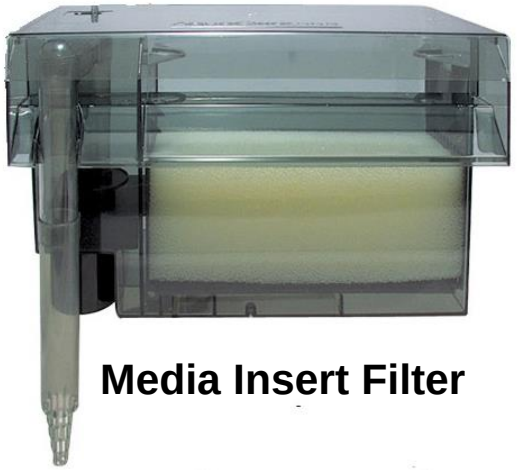
AquaEuro – Monthly

CLEANING FILTER

1. Loosen front cover screw, turn counterclockwise (Fig.1).
2. Pull front hood cover out gently (Fig.2).
3. Loosen screws of filter and remove the filter (Fig.3.4).
4. Lift and remove side draft hood (Fig.5).
5. Loosen screw of side draft hood & remove the filter (Fig.6.7).
6. Remove the dust with brush or vacuum cleaner or rinse it well with water and completely dry it before reinstalling (Fig.8).
7. Install all the parts back by counter steps.



Filter Types



Media Insert Filter

Bio-Wheel Filter

Media Cartridge Filter

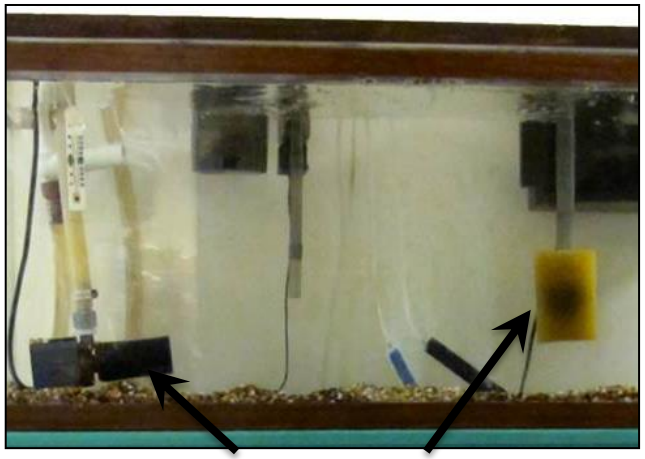
Canister Filter

Under Gravel Filter
Not recommended

How To Maintain Filtration/Aeration

Carbon/Sponge/Bio Filter

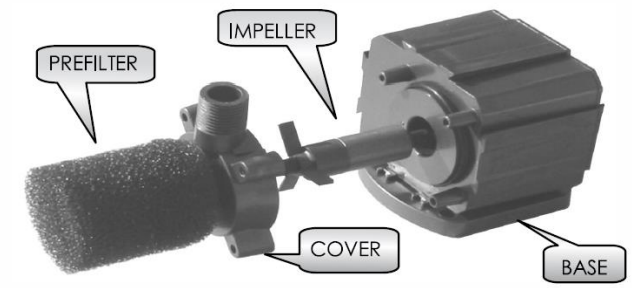
Bio Filter



Chiller Pump Filter Pre-Filter tube

Keep sponges on any intakes clean by removing and washing as needed.
Chiller pump pre-filter should be cleaned weekly.

Mag Drive Pump for Aqua Euro



Regularly check flow from the filter (part of student "Systems" check):
Low flow may be the result of

- Low tank water level; solve by adding de-chlorinated water.
- A clog in the filter media; solve by flushing the filter in a bucket of tank water. - **AVOID USEING TAP WATER TO CLEAN FILTERS**.
- Clogged intake; solve by removing the intake, clean, reinstall.
- Check impeller shafts; solve by gently finger cleaning impellor shaft.

There are impellers in all filers and pumps.

Regularly check the aerator (part of student "Systems" check):
If bubbling is not vigorous, check for

- Low air supply from pump; solve by replacing the pump.
- Clogged air stone; solve by cleaning with a toothbrush or replacing.

What To Monitor When

Every school day

- ✓ Check and record water temperature.
- ✓ Check for any trash in the tank and remove it with a net.
- ✓ Check for dead eggs or fish and remove it with net.
- ✓ Check that the filter/aeration system is running and bubbling.
- ✓ Note any unusual fish behavior, ex. Circling, curved alevin.
- ✓ Record information on charts.

Weekly or more frequently if levels rise

- ✓ Check ammonia, nitrite, and pH with Master test kit (nitrate is optional, but of interest).
- ✓ Record information on chart.

March thru May

- ✓ Rake a net across the gravel to check for uneaten food or fish waste.
- ✓ Clean tank as needed or at minimum, change 15 gals per week.

Involving Students

Student jobs

Temperature specialist

Feeder

Trash / mortality / systems specialist

Ammonia tester

Nitrite tester

Nitrate tester (optional test)

pH tester

Cleaner

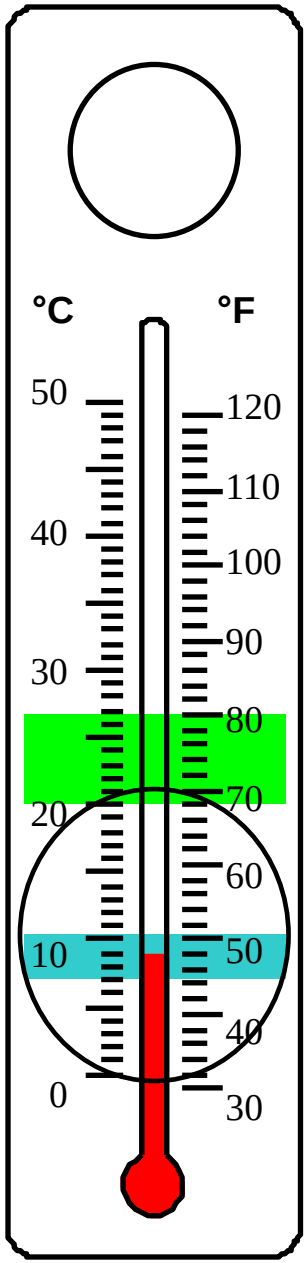
Choose a model that works for you and your students.

- Alternating teams
- Tank monitoring or feeding as rewards
- Alphabetical order
- One team to monitor throughout project
- One team to help with cleaning throughout project
- ???

Checking Temperature

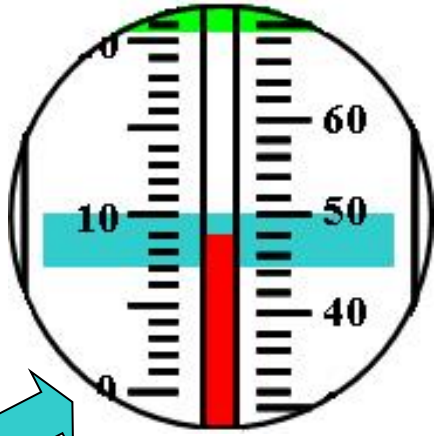
Check daily. The ideal temperature for salmon is between 45°F and 50°F.

High or low temperature indicates a problem with the chiller.



Safe zone for tropical fish

Safe zone for salmon



Temperature shown: 48°F

Feeding To Reduce Maintenance

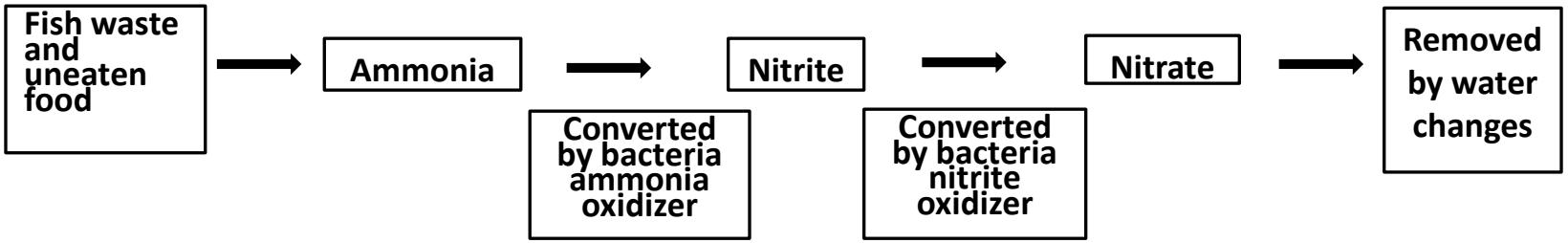
- ✓Do not feed your fish until they have completely absorbed their yolk sacs.
- ✓Begin by “tease feeding” in tiny amounts until your fish learn to eat.
- ✓Feed no more than your fish will eat before it settles to the bottom.
- ✓Test water at least once per week while in fry stage.
- ✓Switch to flake food as fry grow because it stays suspended longer.
- ✓Switch to bloodworms a few weeks before release; they too, stay suspended.
- ✓Do not feed on weekends but do arrange for feeding over long holidays and vacations.

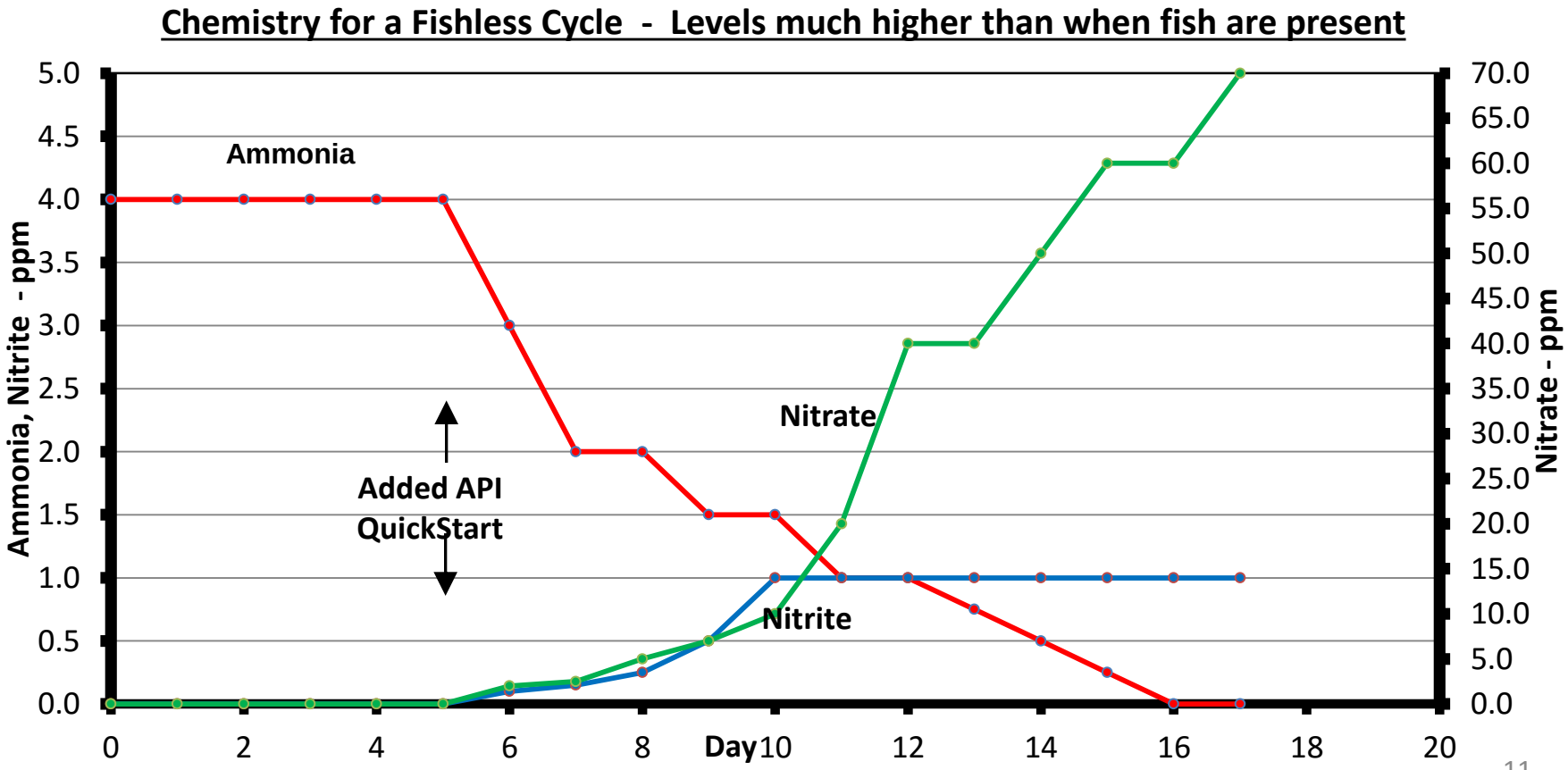
This is the “suture line,” where the salmon’s yolk sac used to be. **<u>This needs to be almost completely invisible before they are fed.</u>** The full absorption of the yolk sac is known as “buttoning up.”

These chinook were fed for the first time about A WEEK **AFTER** this picture was taken.

The fish will look very skinny at this point, but they are OK!

Tank Chemistry

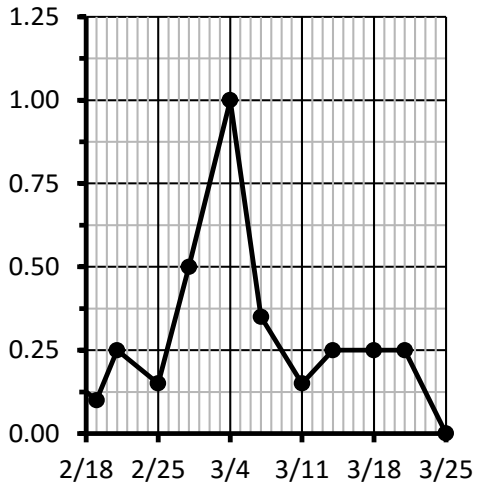




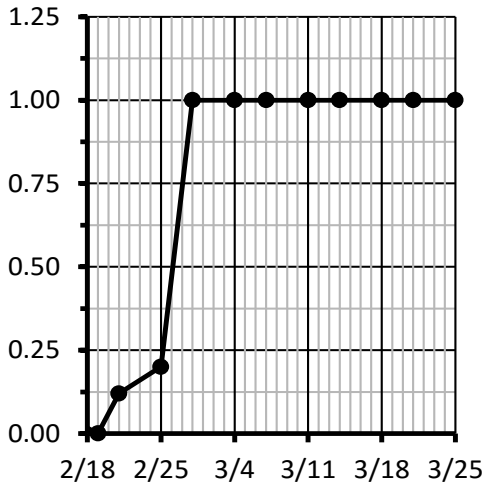
Ammonia / Nitrite / Mortality Relationship

Large amount of food on bottom corresponded to an ammonia spike at West Seattle Elementary in the spring of 2013.

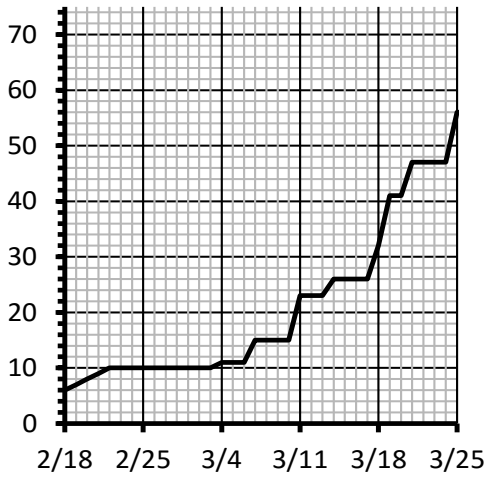
Ammonia



Nitrite



Mortality



Need to react fast if ammonia or nitrite rises

Maintaining Biological Filtration

Beneficial bacteria break down egg casings, fish waste, and uneaten food. This process, called biological filtration, can prevent or solve problems with high ammonia or nitrite.

What increases beneficial bacteria
- clean, natural gravel
- plenty of suitable surface area for bacteria to attach (in gravel, filter, etc.)

What decreases beneficial bacteria
- unsuitable gravel (mineral-poor, artificially colored, volcanic, etc.)
- volcanic rocks
- toxins in the gravel
- lack of oxygen, algae growth
- Excessive cleaning of filter media

Products are available to introduce bacteria to the tank, you may use a fishless cycle, or you may keep the tank filled all year.

Testing for Water Quality

Ammonia: Goal 0 ppm. Level can rise as egg casings decay, fish waste builds up, or uneaten food sits on the bottom of the tank. High ammonia can poison your fish. **Careful monitoring of ammonia is essential.** Water changes are the best way to offset a rise in level while waiting for beneficial bacteria to start conversion of ammonia to nitrite.

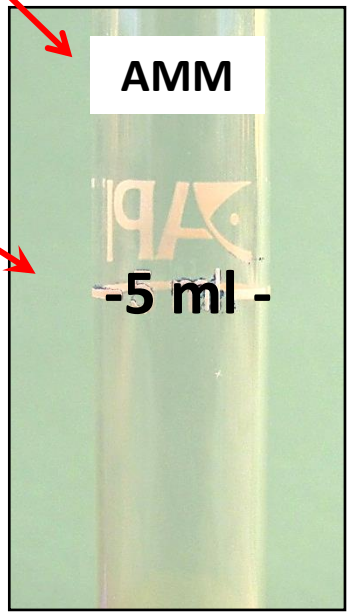
Nitrite: Goal 0 ppm. Nitrite is produced by the beneficial bacteria that convert ammonia to nitrite. High nitrite quickly leads to fish death and trace amount will stress the fish, making them susceptible to disease.

Nitrate: Goal between 0 - 40 ppm. Nitrate is produced by beneficial bacteria that convert nitrite to nitrate. Water changes reduce the nitrate level.

pH: Goal between 7.0 ppm and 7.6 ppm. Higher and lower levels increase the toxicity of chemicals such as ammonia and nitrite.

Filling Test Tubes

- **Use a different tube per test!**
- Mark all new test tubes with colored tape or permeant marker to avoid mixing of different test chemicals.
- Have a minute timer next you. Each test has different requirements.
- Dip a paper cup into the water.
- Fill a clean test tube accurately to the 5ml mark.
- Place it back into holder, tubes break easily.
- Read provided instructions, add recommended drops to each tube.
- Set timer.
- Read results and add to chart.
- Rise tubes well with sink water and air dry. Do not allow chemicals to dry in tubes.



Testing for Ammonia

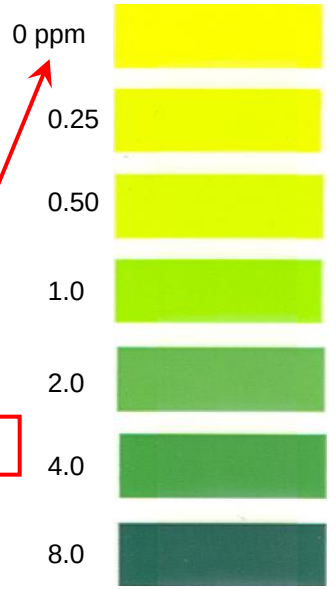
Reduce ammonia by replacing half the water with water treated with a de-chlorinator. Normally, the amount of water removed and replaced during gravel vacuuming is enough to keep ammonia at a safe level once beneficial bacteria take over.

- Fill test tube with 5 ml of tank water.
- Add 8 drops of reagent #1.
- Add 8 drops of reagent #2.
- Gently shake for 5 seconds.
- Wait for 5 minutes.
- Read.

Green tape on bottle and test tube to prevent mix-up

Goal: 0 ppm

Freshwater Ammonia (NH_3/NH_4) Color Card



Color card in test kit

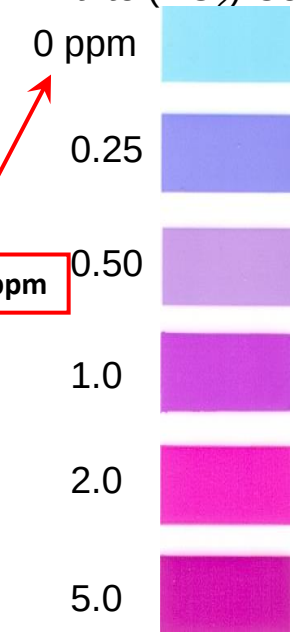
Testing for Nitrite

Reduce nitrite by replacing half the water with water treated with a de-chlorinator. Normally, beneficial bacteria will then take over and the level of nitrite will decline. While this process is taking place, add aquarium salt to reduce nitrite toxicity.

- Fill test tube with 5 ml of tank water.
- Add 5 drops of reagent
- Gently shake for 5 seconds.
- Wait for 5 minutes.
- Read.

Red tape on bottle and test tube to prevent mix-up

Fresh and salt
Nitrite (NO_2) Color Card

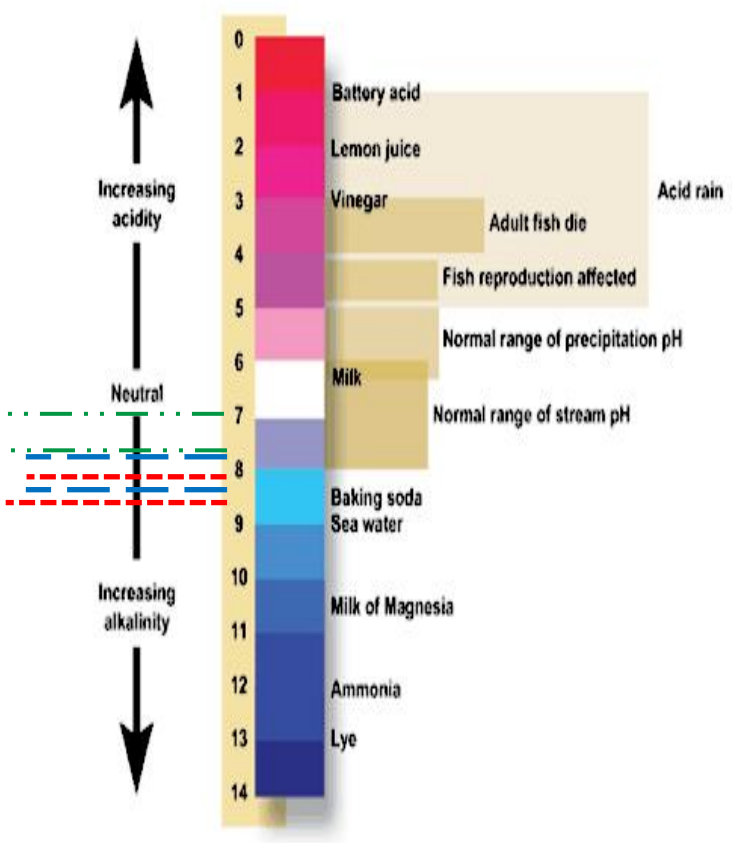


Goal: 0 ppm

Color card in test kit

About pH

LOW



HIGH

Salmon Goal:
7.0 – 7.6 ppm

Cedar River:
7.82 – 8.35 ppm

Tolt River:
8.16 – 8.61 ppm

Effect on Ammonia

Above 7.0 – More NH_3 (more toxic form)

Below 7.0 – More NH_4+ (less toxic form)

Not recommended to change or alter pH until ammonia cycle is complete

Below 6.0 – Nitrification bacteria die off.

Cedar and Tolt pH readings taken 5/13/14

About pH Levels

Wait 24-48 hours after filling tank, before testing for pH. Aeration introduces oxygen and releases carbon dioxide.

- Water Changes – Over time, the pH in your aquarium will drop. The most effective method to raise it is to simply perform regular water changes. Vacuuming all of the uneaten food and waste will also help to counter the tendency for the pH to drop over time.
- Rocks or substrate - Add rocks or substrate (gravel) raises pH.
- Aeration – Increases oxygen concentration in the water and raises pH.
- Baking soda – Baking soda will raise the pH. Needs to be constant addition (you cannot just add it once). A severe spike will occur when too much is added at one time. A general rule is 3/4 teaspoon per 10 gallons. Err on the side of too little, the ratio is just a rule of thumb. Take it slowly so you do not shock or kill your fish. Dissolve baking soda in some water before adding it to the tank.
- Shells – Shells raise the pH.
- Lowering the pH is often more difficult than raising it. Driftwood, peat moss and carbon dioxide will lower pH.
- Chemicals for raising and lowering pH – Commercial buffers available can lead to large pH spikes and usually are only a temporary fix. However, if you have tried everything else and nothing is working, the buffers may do the trick.

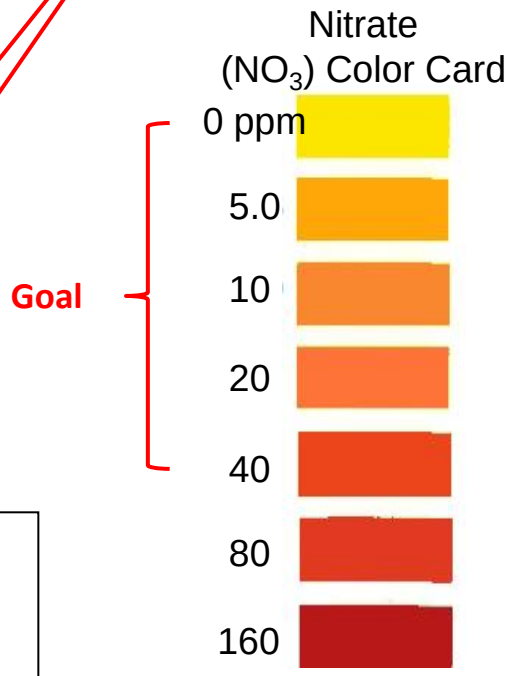
It is much more important to have a stable pH than to maintain a specific pH value. Adjusting the pH can be dangerous as swings of just 0.3 in a day can be deadly. Therefore, unless you have consistently low pH (high would be unusual), it is better to make small water changes than adjust your pH.

Testing for Nitrate

Reduce nitrate by replacing water with water treated with a de-chlorinator.

Blue tape on bottle and test tube to prevent mix-up

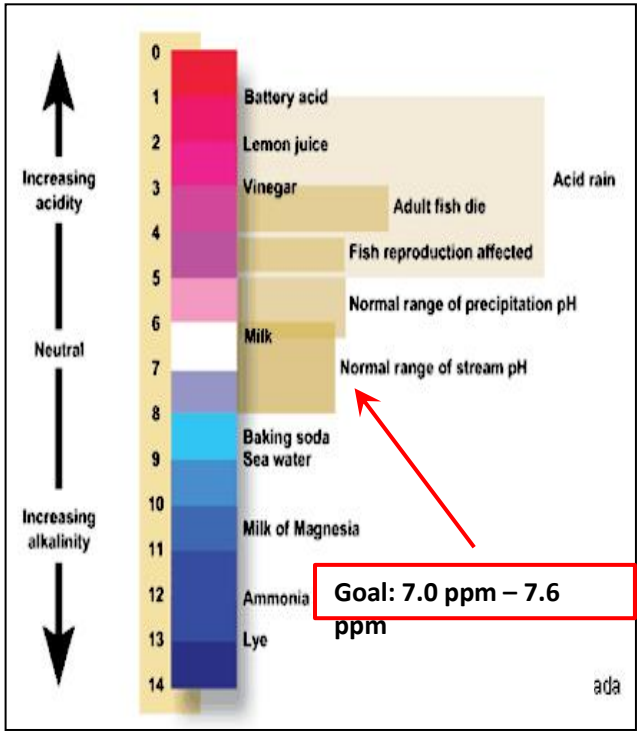
- Fill test tube with 5 ml of tank water.
- Add 10 drops of reagent #1.
- Add 10 drops of reagent #2.
- Gently shake for 5 seconds.
- Wait for 5 minutes.
- Read.



Color card in test kit

Testing for pH

LOW



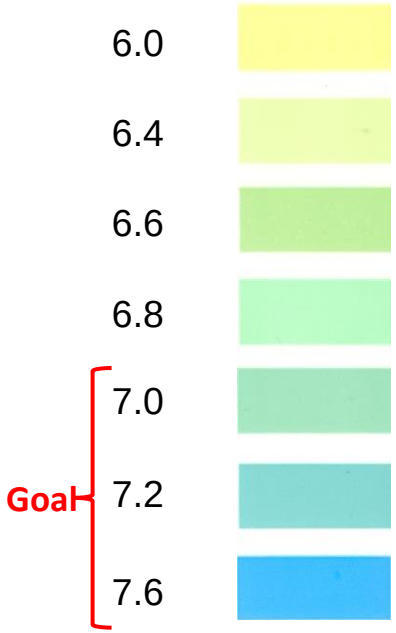
HIGH

Lower or raise pH using a pH adjustment kit, mineral block or biobag.

- Fill test tube with 5 ml of tank water.
- Add 3 drops of reagent.
- Gently shake for 5 seconds.
- Read.

Yellow tape on bottle and test tube to prevent mix-up

Freshwater pH Color Card



Color card in test kit

Accumulated Thermal Units (ATU)

Temperature affects everything from the rate at which salmon eggs develop to the amount of feed that fry require and the amount of dissolved oxygen that water will hold. Accumulated thermal units (ATUs) are one way to measure temperature.

What is an ATU

As measured in Fahrenheit, the daily ATU is water temperature minus 32. For example, if the first day of incubation occurred when the water was 45°F, the calculation would be 45 - 32 = 13. ATU for each day is added to the previous sum.

ATU measurements are used in hatcheries and school incubation programs to determine the stage of egg development and to predict date of hatch and date when alevins will "button up" to become fry (in the wild, emerge from the gravel). In a creek or river, other factors such as oxygen level and water flow also influence the speed of development. In a controlled environment, however, temperature is usually the only variable.

Accumulated Temperature Units (ATUs) Required To Reach Developmental Stages in Salmonids

SPECIES	STAGE	ATUs in °F
CHINOOK	To hatch	860 - 980
	To fry stage	1620 - 1800
CHUM SALMON	To hatch	850 - 950
	To fry stage	1620 - 1800
COHO SALMON	To hatch	720 - 900
	To fry stage	1260 - 1450

Monitoring

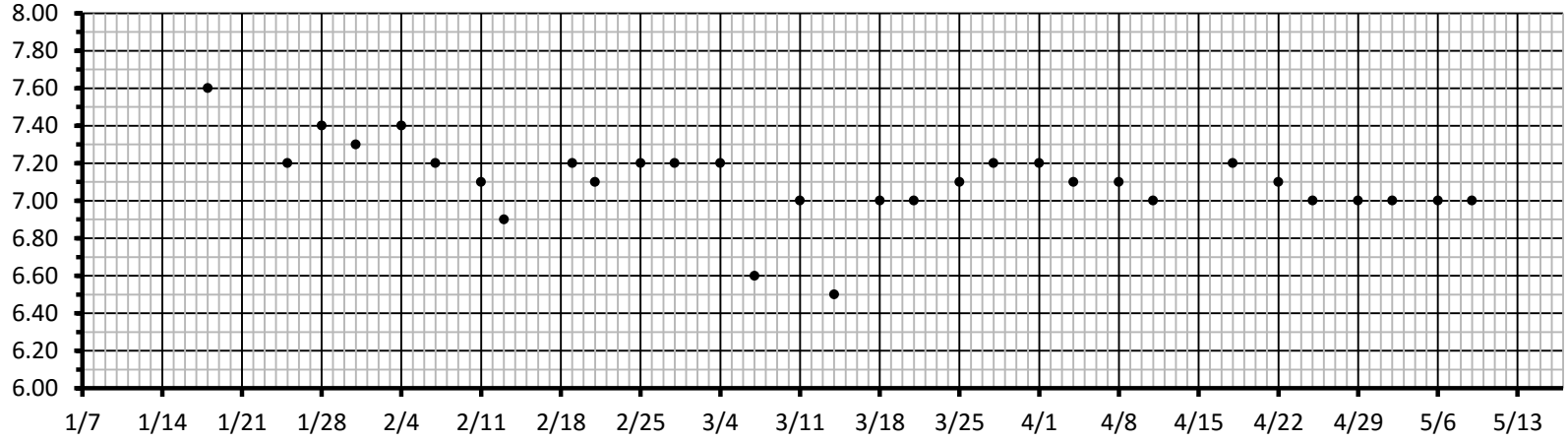
1. Make an X to indicate that feeding and trash systems have been checked.
2. Track mortality and keep the count of live eggs/fish up-to-date.

Comments to include Hatch, Mineral block addition, Cleaning, etc. If temperature not recorded, use 48°F

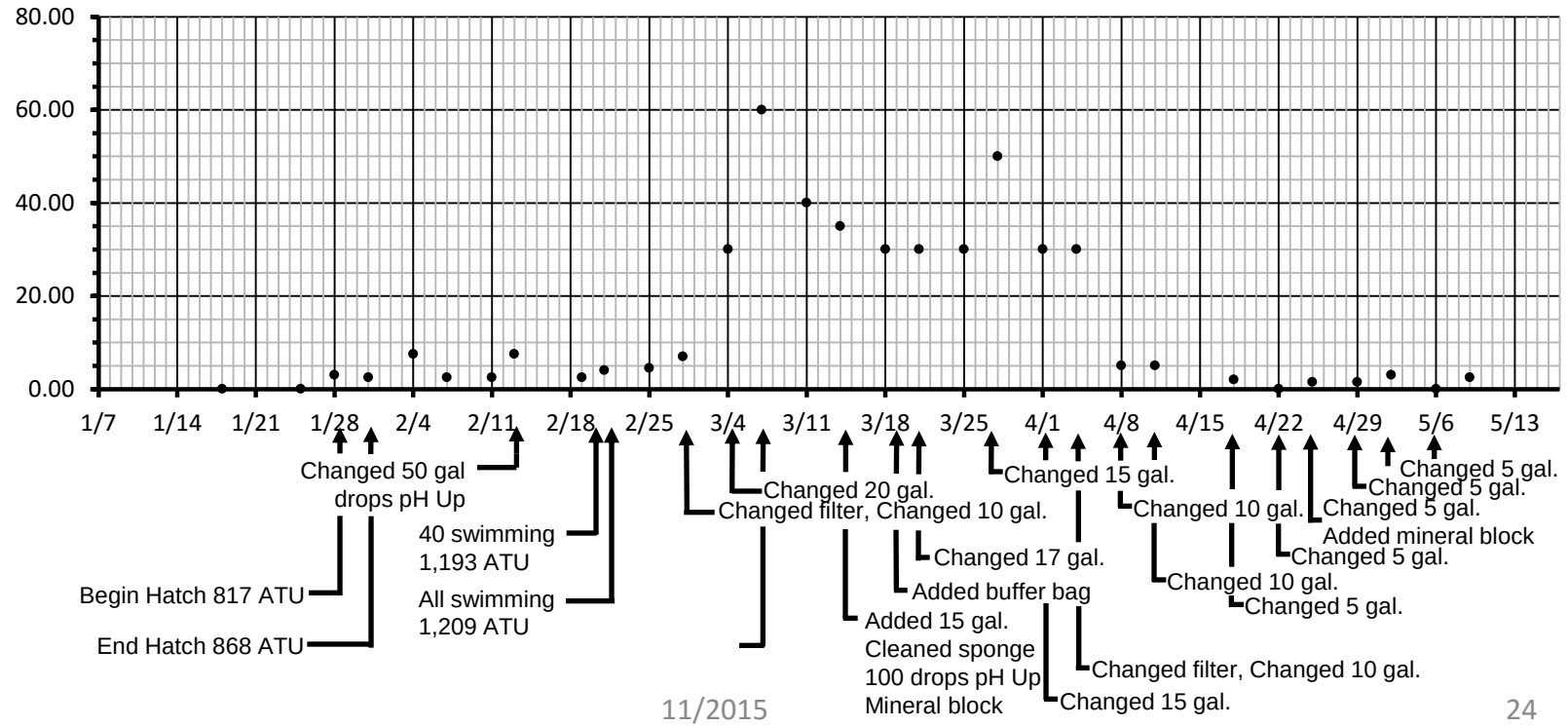
Date	Feeding	Trash/ Systems	Mortality	Count	Ammonia	Nitrite	pH	Nitrate	Temp °F	ATU °F	Comment
3/1	X			190					50	1,342	
3/2				190					48	1,358	
3/3				190					48	1,374	
3/4	X	X	1	189	1.00	1.00	7.2	30.0	49	1,391	Changed 20 gallons of water
3/5	X			189					48	1,407	
3/6	X	X		189					48	1,423	
3/7	X	X	4	185	0.35	1.00	6.6	60.0	48	1,439	Cleaned sponge, Added 100 drops pH Up, Added mineral block
3/8	X			185					49	1,456	
3/9				185					48	1,472	
3/10				185					49	1,489	
3/11	X	X	8	177	0.15	1.00	7.0	40.0	49	1,506	Changed 25 gallons of water

Charting

pH

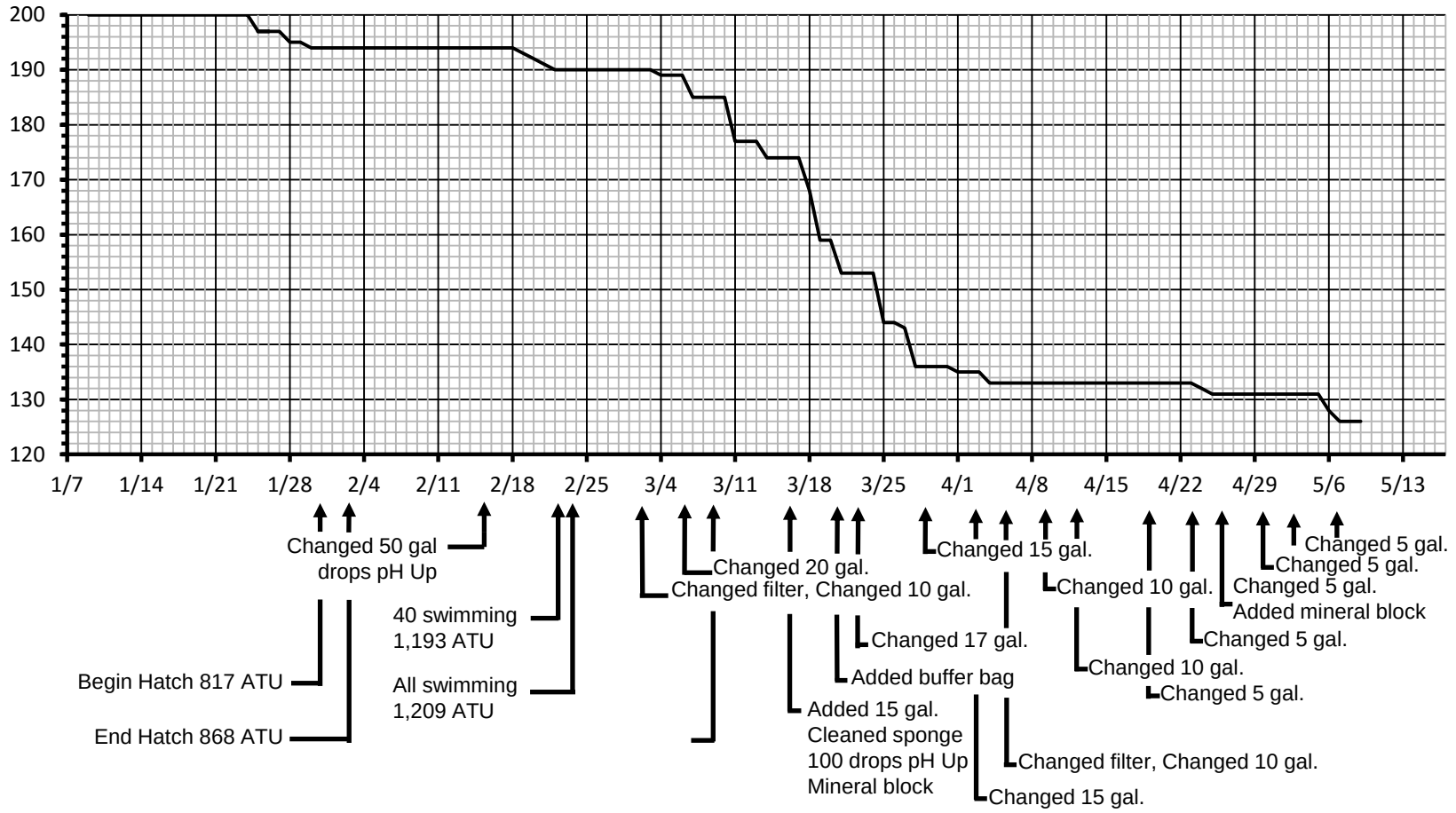


Nitrate



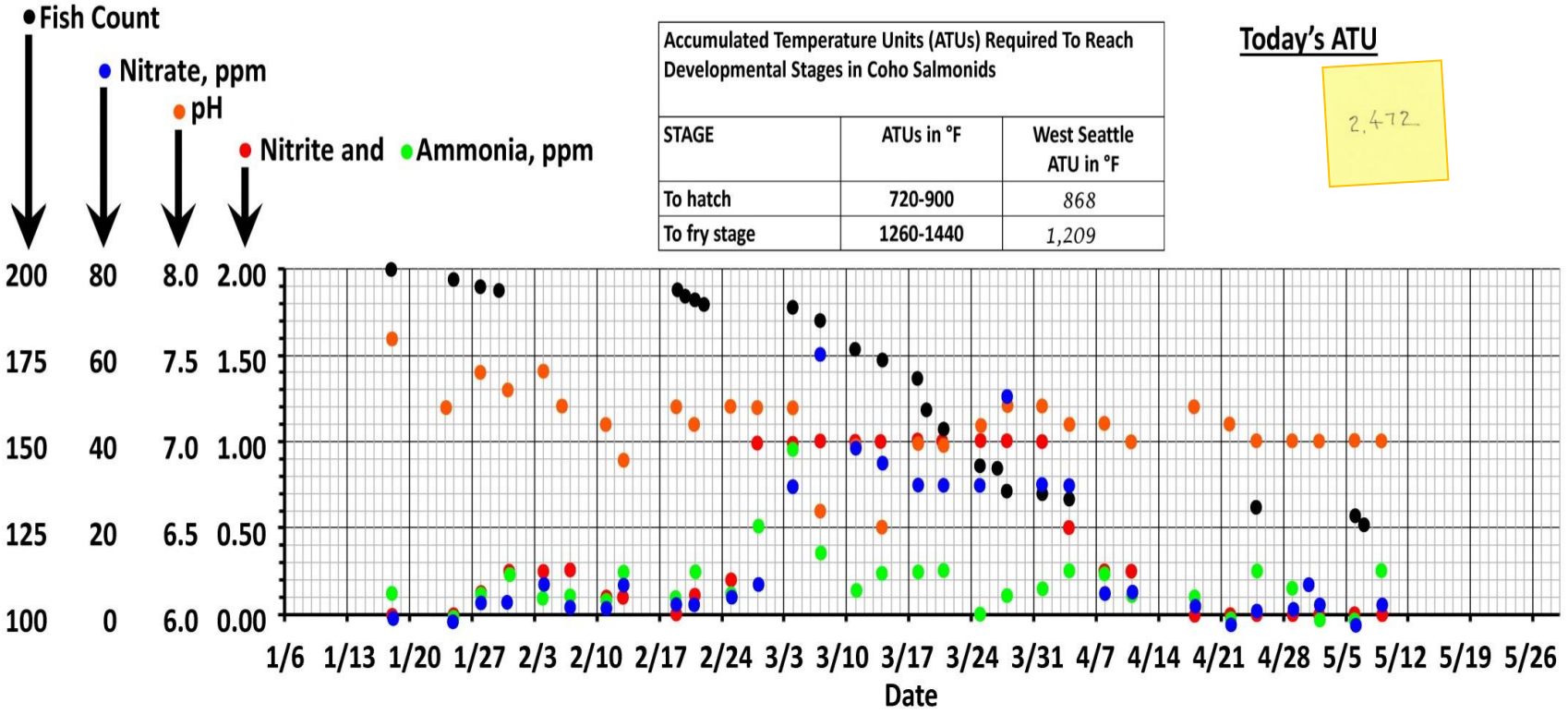
Charting

Number of Fish



Student Tracking Poster

Tank Chemistry



Accumulated Temperature Units (ATUs) Required To Reach Developmental Stages in Coho Salmonids		
STAGE	ATUs in °F	West Seattle ATU in °F
To hatch	720-900	*868*
To fry stage	1260-1440	*1,209*

Today's ATU

2,472

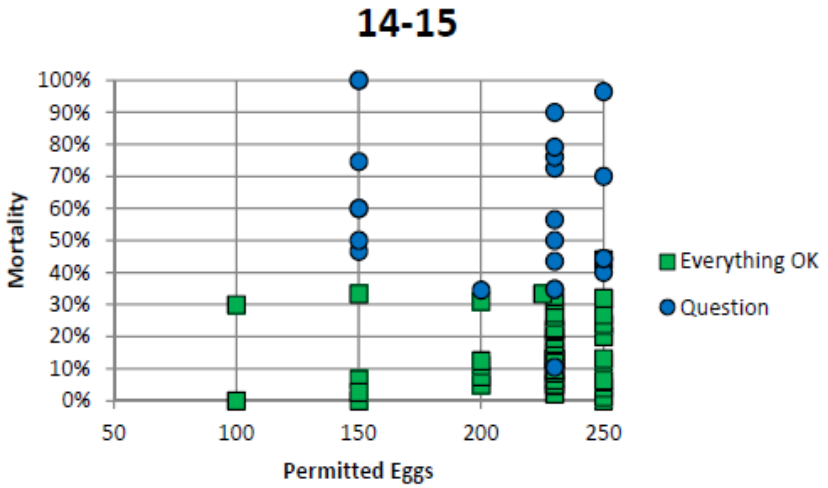
A Look at Success Rate

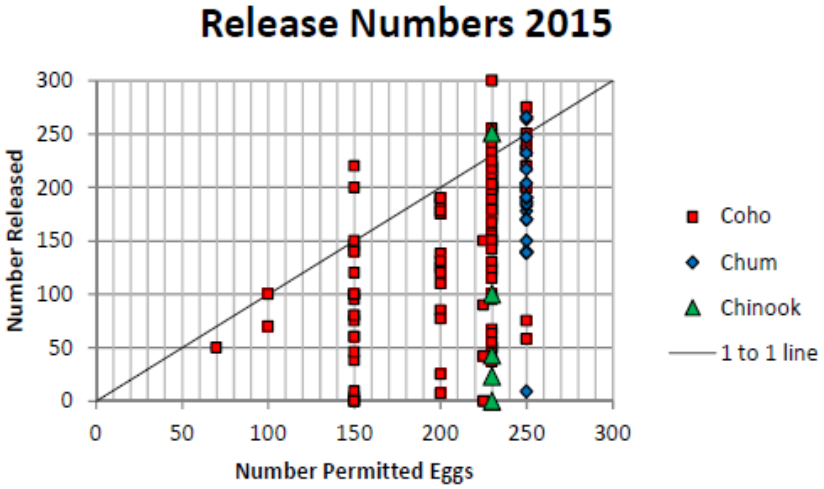
Information is based on 2015 Release Report.

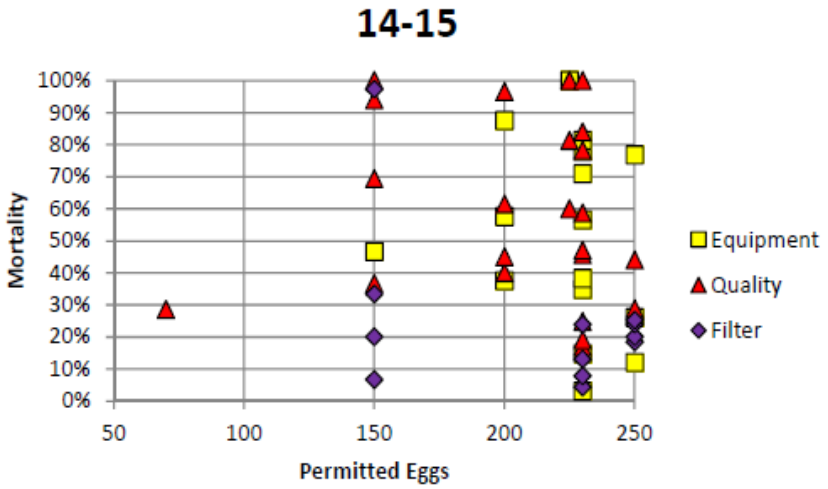
Question label means that the data was hard to interpret.

Equipment and water quality seem to be the prime reasons for higher mortality.

Note: Those reporting more released than permitted not shown in Mortality.

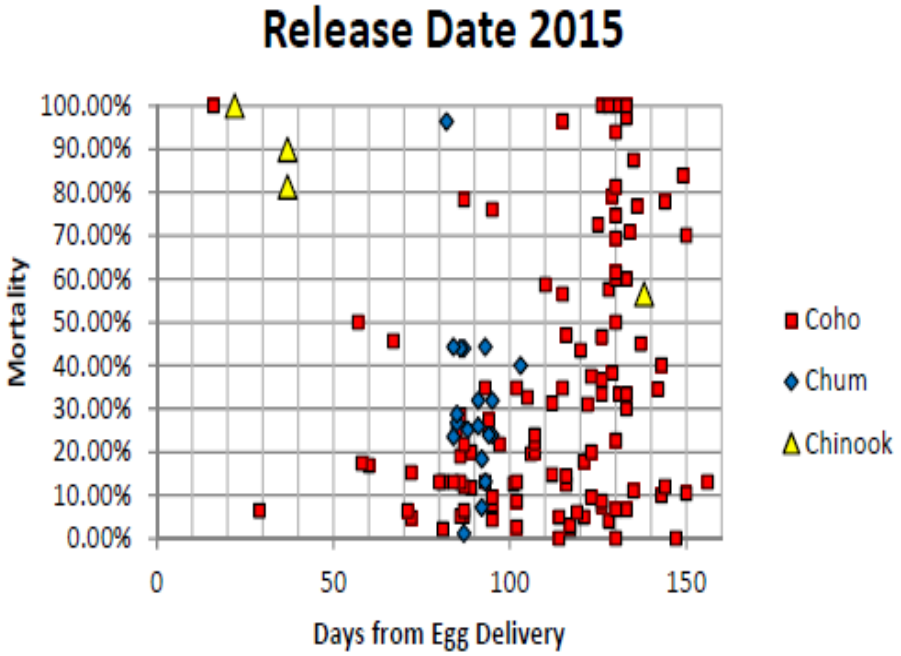






Effect of Release Date on Success

There is a tradeoff between keeping the fish through spring break and putting fish into the wild with little hope of surviving.



Teacher's Comments

New equipment, some caught in high powered filter, high ammonia, filter got clogged and cooler didn't work for a while, water temp went to 70 degrees once. 59%

The filter sucked them up? 20%

Filter suction 13%

Temperature regulator broke so the water was up to room temperature for several days. This was during our break time 77%

Our chiller was going out so we lost about 115 58%

Chiller broke in early April. 71%

Early hatching? 76%

Lack of egg fertilization 10%

No unusual loss after eggs were eyed 20%

I had a nitrogen issue that I couldn't get rid of even with tons of water changes and Nancie giving me chemicals. 84%

Tank Quality - having a parent that knew what he was doing really helped so many survive! 33%

Water chemistry. We lost most of the fish in a 3 day span. Water change stopped die-off. 47%

A fungus led to the death of our fry :(100%

NOT cleaning the water. Just cleaning the filters every 9 days. 81%

Water quality - I take responsibility 13%

It seemed like my numbers were good in the beginning, but I still lost of fish early. 73%

PH of the tank 29%

Email Correspondence with a Teacher

When I started the Salmon in the School program, I had 300 eggs to begin with. I kept that amount for at least five years. Then, two years ago when I was attending a workshop at the Issaquah Hatchery, a 25 year veteran teacher said that 50 salmon eggs worked very well for him and there was no need to have 300+ eggs. I took his advice of 50 and added 20 for security. I am so very happy I only have 70 eggs to work with. The work load is so much less and the survival rate is acceptable. My students are just as happy with 70 as with 300. They do not seem to notice the difference in number.

We go to the end of May so that they are better able to cope in the stream - It is more work because of Spring break.

I know that we can keep the salmon into the May but my practice is to release them the week before our Spring break. That usually means sometime during the first two weeks of April. That way no one is responsible to take care of the salmon while we are away and they are released into Lake Washington.

Did you have any "pinheads" (the fry that don't develop)?

I had about four that did not develop

What We Have Learned So Far

It seems that workload and success would be better with fewer fish in the tank.

Some of the "number of eggs received" seem in error as they are far from the number permitted. Data inconsistencies make coming to a good conclusion difficult.

Next Year:

We will reduce the number of eggs for some Area Coordinators to test the theory that fewer are better.

We will ask for more specific information on the release report to tighten up next year's data.

Teachers should try to make an estimate of the number of eggs received.

Supplies – Annual Consumables

API Freshwater Master Test Kit or other brand. Test strips not recommended. $ 32

Water conditioner with an enzyme to reduce stress on the fish and remove chlorine. $ 6

Filter media and other supplies – will depend on your type of filtration system. $ 10

API Quick Start or other brand. $ 10

*Flake-style fish food $ 3

*Frozen bloodworms (enough for 2-3 weeks) $ 12

*A mineral block to maintain proper pH and water hardness. $ 10

Change out the gravel every three years, or more frequently if pH is difficult to maintain. $ 32

*Optional

Neither Friends of the Issaquah Salmon Hatchery nor the Salmon Education Alliance endorses the products shown.

Equipment References

Filter overview www.youtube.com/watch?v=KICDbuVRF5E

Chillers

AquaEuro http://www.thatpetplace.com/aqua-euro-usa-25-hp-max-chill-chiller-175-gal

Hang-on-back filters

AquaClear brand: https://usa.hagen.com/ www.youtube.com/watch?v=npRF2C84jCE

Marineland brand: https://usa.hagen.com/ www.youtube.com/watch?v=L_mtx9I2Y9I

Whisper brand: http://www.tetra-fish.com/Products/aquarium-power-filters/whisper-ex-aquarium-power-filters.aspx www.youtube.com/watch?v=EF2BCxcGZ3k

Aqueon brand: http://www.aqueonproducts.com/products/aqueon-power-filter74412.htm www.youtube.com/watch?v=5mIDfn6sDzU

Typical canister filters

Fluval brand: www.youtube.com/watch?v=vbXOY703GP8

PennPlax brand: www.youtube.com/watch?v=H1Qlh5Mh8Nc

Aquatop brand: www.youtube.com/watch?v=FMqgOLzXHMI

Air pumps

Typical 120 vac pump: www.youtube.com/watch?v=i-c0bzn-2Z8

Typical battery pump: www.youtube.com/watch?v=R88g3ifBv18

Gravel vacuum

With valve: www.youtube.com/watch?v=D6Re04cYJcY

These sites are for information only. Neither Friends of the Issaquah Salmon Hatchery nor the Salmon Education Alliance endorses the products shown.